Omaha Public Power District

444 South 16th Street Mall
Omaha NE 68102-2247

May 17, 2005
LIC-05-0062

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

References:
1. Docket No. 50-285
2. Letter from Samuel J. Collins (NRC) to Ross Ridenoure (OPPD) dated February 11, 2003, Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (EA-03-009) (NRC-03-025) (ML030380470)
3. Letter from R. William Borchardt (NRC) to Ross Ridenoure (OPPD) dated February 20, 2004, Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (NRC-04-0022) (ML040220181)
4. Letter from Ralph L. Phelps (OPPD) to Document Control Desk (NRC) dated April 14, 2005, Fort Calhoun Station Unit No. 1, Revised Relaxation Request for First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (LIC-05-0057)

SUBJECT: Fort Calhoun Station Unit No. 1, Response to Request for Additional Information on the Revised Relaxation Request for First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors

In Reference 4, the Omaha Public Power District (OPPD) provided information in support of a relaxation request with respect to Reference 3. In a phone call on May 16, 2005, the NRC requested additional information concerning Reference 4. OPPD is providing the requested information as Attachment 1 to this letter.

OPPD requests that the NRC complete its review and approval of this relaxation request by May 25, 2005.

If you have any questions or require additional information, please contact Thomas R. Byrne at (402) 533-7368.

Sincerely,

R J Phelps 5-17-05

Ralph L. Phelps
Division Manager
Nuclear Engineering

RLP/TRB/trb

Attachment 1 - Response to Request for Additional Information on the Revised Relaxation Request for First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors

Attachment 1

Response to Request for Additional Information on the Revised Relaxation Request for First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors

Attachment 1

Response to Request for Additional Information on the Revised Relaxation Request for First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors

NRC Question 1:

Please provide a detailed explanation of the hardship associated with removal of the thermal sleeve for Control Element Drive Mechanism (CEDM) penetration nozzle 25.

OPPD Response:

The rod control system at Fort Calhoun Station Unit No. 1 (FCS) is a unique design that uses a rack and pinion CEDM. Palisades is the only other plant with rack and pinion CEDMs, but their configuration under the reactor pressure vessel (RPV) head is very different from FCS, in that their CEDM extension shafts can be removed from the top. The rack and pinion design imposes a significant constraint on performance of a RPV head inspection because the CEDM extension shaft that connects the drive mechanism to the Control Element Assembly (CEA) remains installed in the RPV head nozzle when the reactor is disassembled. The presence of the CEDM extension shaft severely limits access to the nozzle inside diameter (ID) for inspection purposes. Inspection access is further complicated by the thermal sleeve that is installed in the annulus between the CEDM extension shaft and the CEDM nozzle.

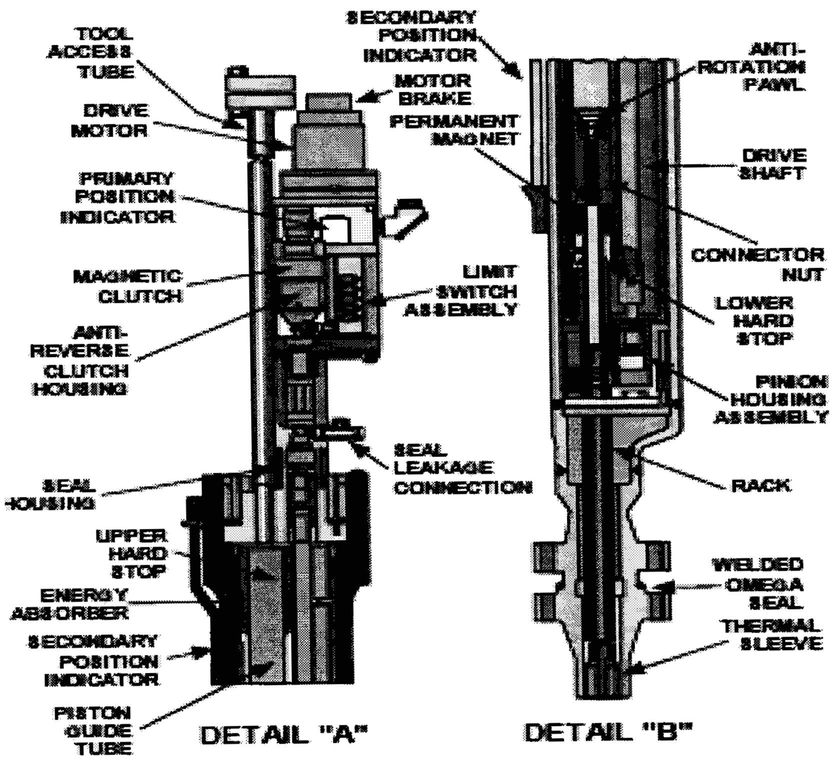
FCS has a "scram weight" at the end of each CEDM extension shaft that precludes CEDM extension shaft removal from the top of the RPV head, necessitating their removal from below the RPV head (See Reference 1, Attachment 1, Figure 3, Page 15). Palisades does not have these weights and can remove their extension shafts from the top of the RPV head.

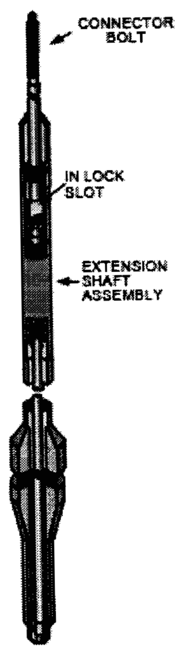
The basic component arrangement of the system is shown in Detail "A" (upper components) and Detail "B" (lower components). The components of interest in this discussion are as follows:

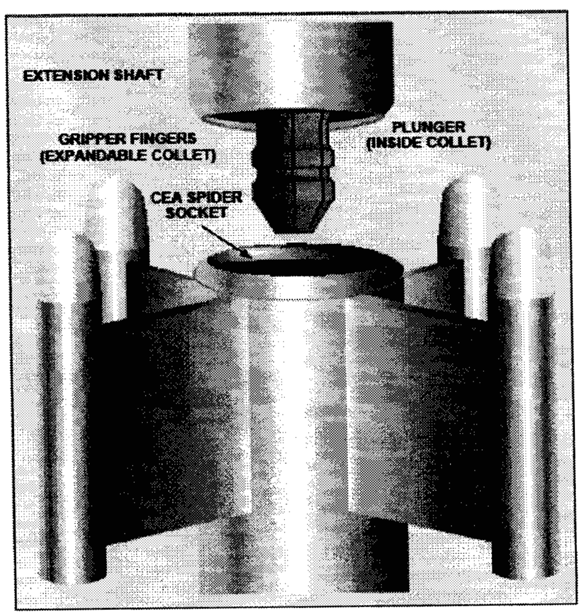
- Extension shaft assembly – supports the CEA spider
- Connector bolt – supports the extension shaft assembly
- Connector nut – supports the connector bolt
- Rack raises and lowers the rack extension to raise the CEA

The CEDM extension shaft assembly is inserted through the CEDM nozzle from underneath the RPV head and extends through the rack into the piston guide tube.

During initial assembly of the RPV head, personnel were positioned in the reactor vessel and the CEDM extension shafts were manually guided into the CEDM nozzle and mated with the CEDM rack assembly. The CEDM extension shafts have never been removed during the 30+ years of FCS operation. The CEDM extension shafts are approximately 21 feet long and are an engineered component which cannot be cut. The location of the CEDM extension shaft affects pinion assembly alignment for raising and lowering the CEA and the dashpot assembly, which can affect CEA drop time. Removal of these extension shafts can allow accumulated debris to move into these sensitive locations.







In order to remove the CEDM extension shaft on CEDM nozzle 25, the RPV head will be installed on the reactor vessel and the CEDM extension shaft will be lowered until it rests on the CEA spider. The CEDM connector nut will then be removed and the reactor head will be lifted and placed on the head stand. It is anticipated that the CEDM extension shaft will be left resting in the Upper Guide Structure in the reactor vessel. However, since this operation has never been performed, it is not certain that the CEDM connector bolt will disengage smoothly from the CEDM rack assembly and slide downward while the RPV head is being lifted. Additional rack extensions may need to be removed to gain proper clearance and a pathway to access CEDM nozzle 25.

With the CEDM extension shaft(s) removed, the RPV head will be placed in the head lay down area. The configuration of the thermal sleeve cutting equipment requires the RPV head to be raised approximately two feet above the normal resting height. Due to the tight clearances in this area, this additional two feet of height will require removal of interferences and rotating the RPV head into an off-normal orientation. The thermal sleeve will be cut above the CEDM nozzle inspection area and removed. The cutting operation will be performed using precision cutting equipment to avoid any possibility of damage to the CEDM nozzle ID. Industry experience has shown, however, that there is a risk of introducing tool marks on the ID of the nozzle. Special cutting equipment is required to perform this operation because the thermal sleeve will be cut approximately 24 inches above the bottom of the CEDM nozzle. Once the thermal sleeve has been cut and removed, additional special tooling will be used to reinstall the original "flare" on the remaining end of the thermal sleeve. The flare is required to prevent interference with the CEDM rack as it raises and lowers the CEA.

When the thermal sleeve has been removed, the ID inspection of CEDM nozzle 25 can be completed with the normal eddy-current inspection equipment used for the RPV head inspection. For re-assembly after completion of the inspection, the reactor vessel head will be positioned approximately nine feet above the reactor vessel and tooling will be inserted through the tool access tube into the space below the RPV head. The tooling will then be threaded into a connection on the top of the CEDM connector bolt and the CEDM extension shaft assembly will be hoisted up through the CEDM nozzle and mated with the CEDM rack assembly.

Connecting the cable to the CEDM connector bolt will be a manual operation that must be performed under the reactor vessel head on components that have a measured contact dose reading of 3 rem. The CEDM extension shaft will also need to be manually oriented during the hoisting operation to ensure that it mates properly with the CEDM rack assembly. This evolution is both technically and radiologically challenging and has never been performed since initial assembly of the reactor. Two of the most significant technical challenges are suspending the RPV head in a stable configuration approximately nine feet above the reactor vessel and allowing safe personnel access to the area underneath the RPV head. An additional uncertainty is the ability to properly realign the CEDM extension shaft with the rack assembly. The clearances between the two components are very tight and the CEDM extension shaft must be inserted upward through the entire length of the rack assembly. Once the CEDM extension shaft has been reinstalled, reactor reassembly can be performed in accordance with the normal sequence of refueling activities. There is no way to test for proper re-assembly until the CEA exercise tests, including rod drop times, are performed Any problem emerging at that time would require RPV head disassembly.

The CEDM extension shafts are 21 feet long and the upper end is 0.875 inch in diameter. The upper end is internally and externally threaded, and slotted. The internal thread that would be used for suspending the extension shafts for removal and reinstallation is only 0.31 inch diameter and 0.5 inch minimum full thread depth. Extension shaft lower ends will not withstand accidental dropping. A re-assembly tool will require a tapered lower end. Without such a guide taper, the top of the extension shaft may hang up on the lower end of the rack during reinstallation. Excessive pulling force could break the thread and drop the extension shaft to the floor.

An "As Low As Reasonably Achievable" (ALARA) plan and dose estimate has been prepared for the sequence of activities described above. The dose estimate was prepared for the activities required to complete inspection of the remaining 80 degrees on the ID of CEDM nozzle 25. The total estimated dose to complete inspection of CEDM nozzle 25 is estimated at 10 rem, including allowances for difficulties associated with first-time performance of the CEDM extension shaft removal. Many of the activities must be performed regardless of the number of CEDM extension shafts and thermal sleeves requiring removal. Therefore, the estimated dose to remove one CEDM extension shaft and thermal sleeve is much higher than the estimated dose per nozzle if all extension shafts and thermal sleeves were to be removed.

Therefore, in summary, OPPD considers that completion of the inspection of CEDM nozzle 25, due to the technical and radiological challenges involved, would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

NRC Question 2:

In Attachment 2, Section 2 (Page 4) of Reference 1, OPPD specified an aspect ratio of six (6), while on Page 17 the aspect ratio was specified as ten (10). Please clarify and explain.

OPPD Response:

In Attachment 2, Section 2 (Page 4) of Reference 1, the regions being analyzed are within the inside diameter downhill and uphill sides of the outermost CEDM penetrations (RPV head angles 37.3°, and 41.7 °). The analysis is for axial cracks located in a low stress area that is bounded by a region 1.25 inches to 2.00 inches above the J-groove weld. An aspect ratio (crack length to depth) of six (6) is reasonable for this region based on ASME Code guidelines.

In Attachment 2, Section 4 (Page 17) of Reference 1, the crack growth calculation is for a CEDM internal diameter region 2.00 inches above the J-groove weld to 1.00 inch below the J-groove weld (for reactor vessel head angles 24.6°, 37.3°, and 41.7°). In order to account for the higher stress distribution close to the J-groove weld, a more limiting aspect ratio of ten (10) was used for extra margin in this higher stress region crack growth analysis.

NRC Question 3:

Please provide a detailed explanation to support the position that missing a single scan line is acceptable.

OPPD Response:

Various CEDM nozzles have single missing scan line information in some areas. OPPD has determined in each case that a single missing scan line does not prevent determination of a potential significant flaw, due to the amount of overlap of adjacent scan line coverage in adjacent eddy current traces. These areas are considered to be fully inspected.

The geometry of the probe and driver coil in combination with size of the scanning grid and the defined overlap ensures that any indication, regardless of width or length, will be observed. Adjacent scan lines have an overlap of 27% as shown on Figure 1. This criterion is based on the number and location of sensors in the probe and the overlapping regions of sensitivity resulting from the scan line increment assuring that a valid indication of relevant length should be evident. An indication picked up in one scan line will also be seen by the adjacent scan lines. A missing scan line is most likely caused by small boric acid on deposits or crud accumulation on the nozzle or thermal sleeve surface which causes axial travel resistance on the probe.

Due to features in the scanning mechanism that prevent the probe delivery device from exceeding allowed force limits (intended to prevent probe failure during the scan), the probe automatically retracts when sufficient resistance is detected and begins to scan the next line.

Reference:

1. Letter from Ralph L. Phelps (OPPD) to Document Control Desk (NRC) dated April 14, 2005, Fort Calhoun Station Unit No. 1, Revised Relaxation Request for First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (LIC-05-0057)

Attachment 1, Figure 1

Scan Coverage Geometry